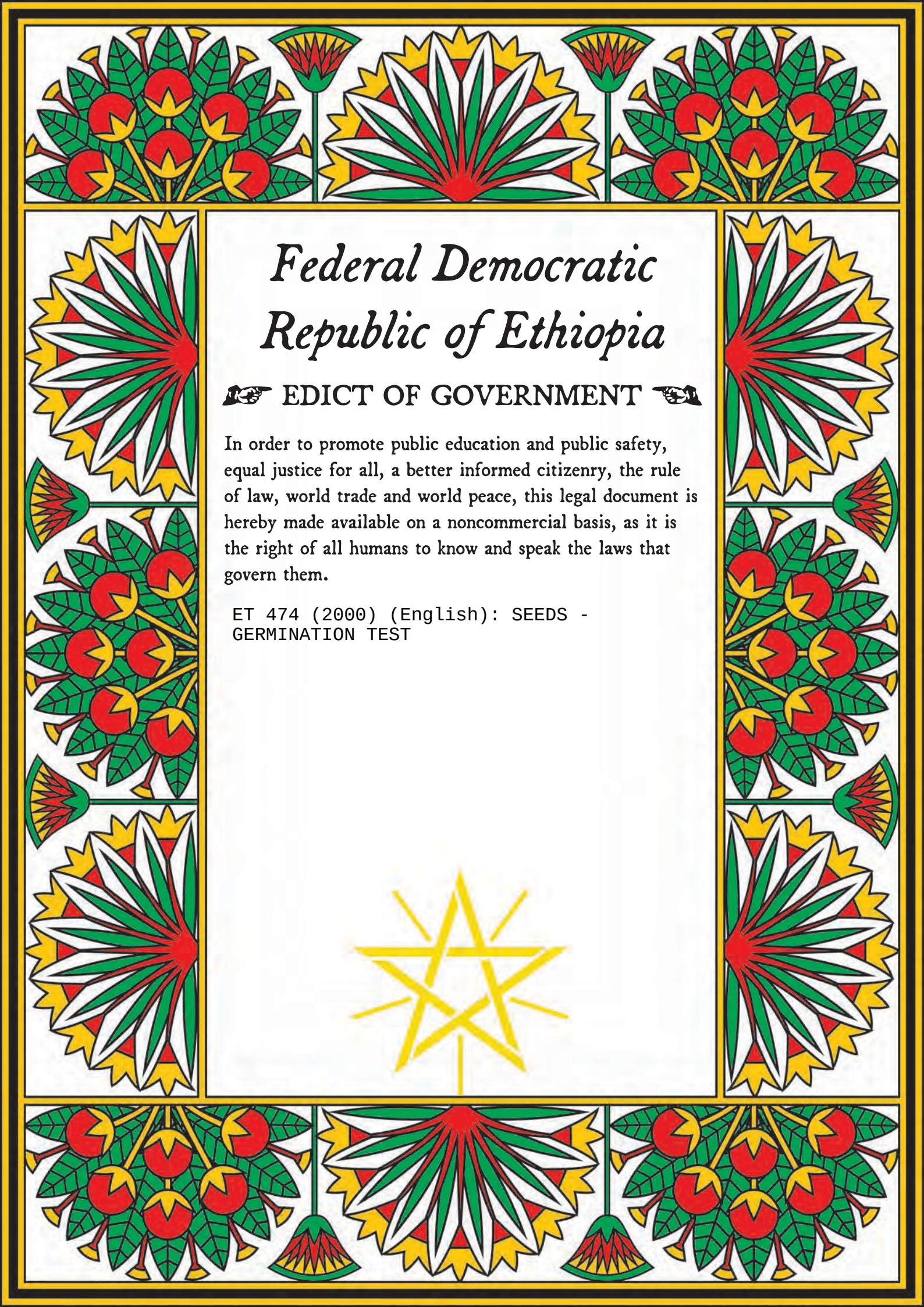




Federal Democratic Republic of Ethiopia

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ET 474 (2000) (English): SEEDS -
GERMINATION TEST



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**ETHIOPIAN
STANDARD**

ES 474:2000

(Reaffirmed :2012)

First edition

Seed - Germination test

ICS: 65.020.20

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Foreword

This Ethiopian Standard has been prepared under the direction of Technical Committee for seeds (TC 16) and published by the Ethiopian Standards Agency (ESA).

The technical contents in the text of this Standard are identical with ES 474:2000 edition while the reissued standard carries some editorial and technical changes observed in the course of systematic review.

Acknowledgement has been made for the use of the indicated publication.

All Ethiopian Standards whether they are adoption of International Standard such as the ASTM ISO and IEC or not, are subject to copy right protection.

Seed — Germination test

1 Scope

This Ethiopian Standard specifies the method for seed germination test to gain information with respect to field planting value of the seed and results, which can be used to compare the value of different seed lots.

2 Normative references

The following standard contain provision which, through reference in this text, constitute provision of this Ethiopian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this Ethiopian Standard are encouraged to investigate the possibility of applying the most recent editions of the Ethiopian Standards indicated below. Registers of currently valid standards are maintained in the Quality and Standards Authority of Ethiopia.

ES 413:2000, *Seed – Terminology*.

ES 471:2000, *Seed – Sampling*.

3. Definitions

For the purpose of this standard, the definitions in ES 413 and the following shall apply.

3.1

germination of a seed in a laboratory test

is emergence and development from the seed embryo of those essential structures which make up seedling, and which indicate the ability to develop into a normal plant under favourable field conditions

3.2

percentage germination

the proportion by number of seeds which have produced seedlings classified as normal under the conditions and within the period specified in clause 8.4

3.3

the essential seedling structures

the following structures are essential to a seedling continued development into a satisfactory plant: root system; shoot axis; cotyledons; terminal buds; coleoptile (Gramineae)

3.4

normal seedlings

seedlings which shall show the capacity for continued development into normal plants when grown in good quality soil and under favourable conditions of water supply, temperature and light. To be classified as normal a seedling must conform with one of the following categories

3.4.1

intact Seedlings

seedlings with all their essential structures well developed, complete, in proportion and healthy

3.4.2

seedlings with slight defects

seedlings showing certain slight defects of their essential structures, provided they show an otherwise satisfactory and balanced development comparable to that of intact seedlings of the same test

3.4.3

seedlings with Secondary Infection

seedlings which it is evident would have conformed with 3.4.1 or 3.4.2 above, but which have been affected by fungi or bacteria from sources other than parent seed

3.5

abnormal seedlings

those seeds which do not show the potential to develop into normal plants when grown in good quality soil, and under favourable conditions of water supply, temperature and light. The following seedlings are classified as abnormal

3.5.1

damaged seedlings

seedlings with any of the essential structures missing or so badly and irreparable damaged that balanced development can not be expected

3.5.2

deformed or unbalanced seedlings

seedlings with weak development or physiological disturbance or in which essential structures are deformed or out of proportion

3.5.3

decayed of seedlings

seedlings with any of their essential structures so diseased or decayed as a result of primary (i.e from the parent seed) infection that normal development is prevented

3.5.4

multigerm seed units

seed units that are capable of producing more than one seedling. Units containing more than one true seed, true seeds containing more than one embryo and fused embryos could produce more than one seedling

3.5.5

ungerminated seeds

seeds which have not germinated by the end of the test period when tested under the permissible substrates and temperatures, the duration of the test, and recommended additional treatments of dormant samples are classified as follows

3.5.6

hard seeds

seeds, which remain hard at the end of the test period, because they have not absorbed water

3.5.7

resh seeds

seeds which are neither hard nor have germinated but remain clean and firm and apparently viable at the end of the test period

3.5.8

dead seeds

seeds, which at the end of the test period are neither hard nor fresh nor have produced any part of a seedling

3.5.9

other categories

ungerminated seeds may be further divided into empty, embryoleless and insect damaged seeds upon request.

4. Principles

4.1 Germination tests shall be made with seeds from the pure seed fraction of a purity test carried out in accordance with ES 474.

4.2 The seed shall receive no pre-treatment except those recommended breaking dormancy. If, at the request of the sender, additional tests are undertaken after any other pre-treatment, the result and the treatment shall be reported.

4.3 The seeds arranged in replicates, shall be placed on or in the substratum and shall be maintained at a favourable moisture level, temperature and light for proper period of time. Then the replicates shall be examined and counts made of the seeds and seedlings in the various categories required for reporting.

5. Materials

The following materials shall be used as substrata:

5.1 Paper

5.2 Sand

5.3 soil and/or (compost are used under special condition)

6. Apparatus

6.1 One of the following types of germination apparatus and counting equipments shall be used:

- a) Bell jar of Jacobbeans apparatus (Copenhagen tank);
- b) Germination cabinet;
- c) Germination room ;
- d) Combined room and germination cabinet ;
- e) Counting boards; and
- f) Vacuum counters.

7. Sampling

Samples shall be taken in accordance with ES 471.

8. Procedure

8.1 Working sample

8.1.1 The pure seed according to clause 4.1 shall be well-mixed and 400 seeds counted at random into replicates of 100, 50 or 25 seeds.

8.1.2 The seeds shall be spaced uniformly on the moist substratum far enough apart to prevent the seedlings, as far as possible, from touching each other before they are counted and removed.

8.2 Test conditions

Proper test methods, substrata, temperatures, light conditions and special treatments for particular species shall be used; the choice of methods will depend largely on the facilities available to the testing station and to some extent on the provenance and condition of the seed sample.

8.3 Special treatment for breaking dormancy

8.3.1 When a proportion of fresh or dormant seeds remain at the end of the test period, complete germination shall be obtained by re testing after a period of dry storage.

8.3.2 One of the following methods shall also be used for agricultural and horticultural seeds to induce germination:

- a) Pre – chilling;
- b) Pre – drying;
- c) Moistening the germination substratum with potassium nitrate (KNO_3);
- d) Low temperature germination;
- e) Preheating;
- f) The gibberellic acid (GA3) - method recommended for *Avena sativa*, *Hordeum vulgare*, *Secale cereal* and *Triticum aestivum*; and
- g) Sealed polyethylene envelopes used where high proportions of fresh ungerminated seeds are found at the end of the standard test. (E.g. on *Trifolium* spp.) Re-testing in a sealed polyethylene envelope of just sufficient size to hold the test satisfactory will usually induce the seeds to germinate.

8.4 Duration of test

8.4.1 The chilling period before or during the test, which is required to break dormancy, shall not be included in the test period.

8.4.2 If at the end of the test period some seeds have just started to germinate, the test shall be prolonged for an additional period of seven days.

8.4.3 Seedlings shall be removed and counted at more frequent intervals during the period of the test when a sample contains seeds infected with fungi or bacteria. Seeds which are obviously dead and decayed, and may, therefore, be a source of contamination of healthy seedlings, shall be removed at each count and the number recorded.

8.5 Evaluation

8.5.1 Every seedling shall be evaluated in accordance with clause 3.

8.5.2 At the end of the normal germination test, the percentage of ungerminated seeds that are viable shall be determined by a biochemical test in accordance with ES 474 dissection.

8.6 Multiple seed structure

8.6.1 Multiple seed units included in the pure seed fraction under clause 3 of ES 471 shall be counted as single seed. The result of the test shall be reported as the percentage of structures that have produced at least one normal seedling. The average number of normal seedlings produced by 100 seed units or the number of seed units, which have produced one, two or more than or two normal seedlings may also be reported at the discretion of the testing station.

8.6.2 When seeds of *Beta vulgaris* shall be tested for monogermity, the numbers of clusters which shall have produced either one, two, or more than normal seedlings shall be determined in the germination test and each shall be expressed as a percentage of the total number of clusters producing at least one normal seedling.

9 Expression of results

9.1 Results shall be expressed as percentage by number.

9.2 When 400 seed replicates of a test are within the maximum tolerated range (Table - 1 of clause 11) herein the average shall represent the percentage germination to be reported on the Analysis certificate; the average percentage shall be calculated to the nearest whole number.

9.3 The result of a test shall be considered unsatisfactory and shall not be reported, and a second test shall be made by the same method or by an alternative method, under the following circumstances.

9.3.1 When dormancy is suspected (as in fresh seeds)

9.3.2 When the range for the 100 seed replicates exceeds the maximum tolerated range in Table - 1 of clause 11 herein.

9.3.3 When there is evidence of errors in test conditions in seedling evaluation or in accuracy in counting.

9.3.4 When there is evidence that the result may not be reliable because of dormancy, phytotoxicity or the spread of fungi or bacteria.

9.3.5 In case of clause (9.3.1), if the result of the second test (which may also be made simultaneously) incompatible with the first, the average of both test shall represent the percentage germination to be reported on the Analysis Certificate. The tests are compatible if the difference between them does not exceed the tolerance prescribed in column 3 of Table - 2 of section 12. When the difference between the first and second tests exceeds the tolerance at least one more test shall be made.

10 Test report

The test report shall include the following information:

10.1 The duration of the test

The period of the germination, first and subsequent counts for individual speceis shall be reported .

10.1.1 The percentages of normal seedlings, abnormal seedlings, hard seeds, fresh ungerminated seeds and dead seeds shall be entered in the appropriate spaces. If the result is nil, for any of these categories, it shall be entered as '-0-' and the space not left blank.

10.1.2 The number of seedling produced by 100 multiple seed structures according to clause 8.6 shall, if required, be reported.

10.1.3 Substrata and temperatures used.

10.1.4 Any special treatments for breaking dormancy clause 8.3 and promoting germination have been used.

10.1.5 The viability of ungerminated seeds and method used to determine it.

11 Maximum tolerated ranges between replicates

This table shall indicate the maximum range (i.e. difference between highest and lowest) in germination percentage tolerable replicates, allowing for random sampling variation only at 0,025 probability. To find the maximum tolerance to the nearest whole number of 4 replicate necessary, from 100 seed replicated by combining the sub replicates of 50 or 25 seeds which were closest together in the germinator. Locate the average in column 1 or 2 of the Table 1 and read off the maximum tolerated range opposite in column 3.

Table 1 – Maximum tolerated ranges between replicates

Average Percentage Germination		Maximum Range	Average Percentage Germination		Maximum
1	2	3	1	2	3
99	2	5	87 to 88	13 to 14	13
98	3	6	84 to 86	15 to 17	14
97	4	7	81 to 83	18 to 20	15
96	5	8	78 to 80	21 to 23	16
95	6	9	73 to 77	24 to 28	17
93-94	7 to 8	10	67 to 72	29 to 34	18
91-92	9 to 10	11	56 to 66	35 to 45	19
89 to 90	11 to 12	12	51 to 55	46 to 50	20

12 Compatibility of testing

The table below indicates the tolerances to be used in deciding if two test shall be compatible allowing for random sampling variation only at 0.025 probability. To determine if two tests are compatible the average percentage germination of the two tests shall be calculated to the nearest whole number and shall be located in column 1 or 2 of Table 2. The tests shall be compatible if the difference between the germination percentage of the two tests shall not exceed the tolerance in column 3 opposite.

Table 2 – Compatibility of tests

Average Percentage Germination		Tolerance Maximum range	Average Percentage Germination		Tolerance
1	2	3	1	2	3
98 to 99	2 to 3	2	77 to 84	17 to 24	6
95 to 97	4 to 6	3	60 to 76	25 to 41	7
91 to 9	7 to 10	4	51 to 59	42 to 50	8
85 to 90	11 to 16	5			



Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010. ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1970.

ESA's objectives are:-

- ❖ Develop Ethiopian standards and establish a system that enable to check weather goods and services are in compliance with the required standards,
- ❖ Facilitate the country's technology transfer through the use of standards,
- ❖ Develop national standards for local products and services so as to make them competitive in the international market.

Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government organizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.

Orders for all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch (Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed in from our website.

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ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the international Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM). It is a founding member of the African Regional Organization for standardization (ARSO).

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